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ABSTRACT

The purpose of this study was to determine the effects of cooperative learning on the attitude and achievement of teachers enrolled in a graduate statistics course. Thirty students received instruction from a faculty member fully trained in cooperative learning methodology. A nine-item survey was administered at the conclusion of the course. Responses were tallied as either positive or negative on factors related to cooperative learning techniques used throughout the semester. Examination scores were compared to those of a comparable group of students taking the same course with another instructor using traditional lecture methods. Results of the survey indicated that 96 percent of the students felt increased support and a reduction in anxiety. Students also felt their comprehension of statistics was augmented by participation in group exercises. T-tests performed on examination scores revealed no significant differences between the two classes. Despite the fact that significant differences in achievement were not evidenced between the two teaching methodologies, the qualitative data suggest that cooperative learning techniques positively influenced student motivation, self-efficacy, level of anxiety, and sense of social cohesiveness. Contains 20 references. (Author)

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The Effect of Cooperative Learning as an Instructional Practice at the College Level

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Graduate level courses in statistics are often required in teacher training institutions for professional educators who wish to pursue degrees at both the Master's and Doctoral levels. Most graduate programs uphold the philosophy that graduate students must be equipped with the

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statistical knowledge and skills that will enable them to be critical consumers of research. Furthermore, many graduate level professionals are expected to perform micro-level and macro-level program evaluations. Conducting such evaluations frequently requires the ability to select appropriate statistical tests and accurately analyze the results. Competencies in performing statistical calculations through the use of a calculator or statistical computer program are necessary.

Graduate students in educational, administrative, and counseling/psychology programs generally enroll in statistics courses because it is a required part of their academic program. Few, if any, would choose statistics as an elective. Furthermore, many students claim to have rather weak mathematical backgrounds and low estimations of self-efficacy in math aptitude. Frequently, graduate students return to school to upgrade their credentials after working in their respective fields for many years. Ten or more years may have elapsed between the last college level math class taken and the current enrollment in a statistics course. For these reasons, college instructors who teach statistics in graduate education programs often encounter high levels of anxiety and low motivation and self-efficacy among their pupils. Research has demonstrated that these attributes are correlated with

underachievement (McKeachie, Pintrich, Lin and Smith, 1986; Schunk, 1984).

Professors of statistics who are also teacher-educators are in a unique position to model state of the art instructional techniques that are effective in addressing the needs of their students. Cooperative learning has been embraced by the education reform movement as a teaching methodology with far reaching benefits for its classrooms of the future (Glickman, 1992). This approach pumps new life into the term "active learning" and, when compared to individualistic and and competitive classroom structures, produces significant gains in achievement and productivity (Johnson, Maryuma, Johnson, Nelson & Skon, 1981). It is becoming increasingly clear that teacher training institutions must begin to incorporate into their curriculum both the theoretical underpinnings of cooperative learning as well as the specific pedagogical skills necessary for its implementation into the classroom. By using this method in the college classroom, professors can model the teaching skills associated with this technique and produce an active learning environment as well.

Although professors in a variety of fields are employing this methodology, the transition to cooperative strategies is occurring on an individual basis and in isolated classrooms (O'Shea, 1991; Rousculp, 1992;

Weimer, 1990). College faculty are reluctant to jump on the bandwagon of a new methodology that is not supported by a solid research base (DeVitis, 1990).

While there is considerable evidence confirming performance benefits of cooperative learning at the elementary and secondary levels, the research base relating exclusively to higher education is substantially smaller. The following review of current research reflects this situation.

Achievement

Johnson, Maruyama, Johnson, Nelson, and Skon (1981) performed a meta-analysis of 122 studies that examined achievement differences between competitive, individualistic, and cooperative classroom studies. Results indicated that in most classrooms, cooperative structures promoted higher achievement. Slavin (1983b, 1884) analyzed 28 studies that compared the relative effectiveness of three cooperative incentive structures: group reward for the individual performance of group members, group reward for a group product, and individual reward for performance tested individually after the group activities were completed. The results indicated that group reward based on the individual performance of group members increased the the overall achievement of the group. He suggested that this particular incentive

structure increased group members efforts to improve the learning of all group members. Lew, Mesch, Johnson, & Johnson (1986) have also demonstrated the effectiveness of this incentive structure on increasing student achievement. There is some evidence that supports the superiority of cooperative learning structures in promoting higher level problem-solving skills (Thomas, Iventosch & Rohwer, 1986).

Motivation and Anxiety

Motivational factors are positively influenced by cooperative classroom structures as well. Webb's (1985, 1988) research demonstrates an increase in helping and tutoring behaviors, especially when group rewards are contingent upon the individual performance of each group member. Student learning is enhanced , in particular, by within group discourse. Giving and receiving verbal explanations and elaborations assists the comprehension and retention of content for all group members.

Ames (1984) work also demonstrates that students' participation in cooperative groups diminishes negative self-perceptions resulting from poor academic performance and reduces performance anxiety. Low-achieving students with low self-perceptions of academic competence increase their level of achievement and self-esteem when working within the cooperative structure. Heterogeneity of group composition also

contributes to student attributions of success to increased effort. Students begin to feel empowered as a result of peer group support and the pooling of skills. In addition, intrinsic motivation in the academic content area is increased because most students find working together is more enjoyable than working individually.

Self-efficacy

Self-efficacy is defined as perceptions of one's ability to perform a specific task (Bandura, 1982). Research demonstrates that perceptions of self-efficacy are important for a number of reasons, it is correlated with high achievement, greater use of deep learning strategies, and greater degrees of effort and persistence with difficult tasks (Thomas, Ivantosch, and Rohwer, 1987; Schunk, 1985). A student's sense of self-efficacy in a particular domain increases as a result of repeated experiences of success of specific tasks in that domain. If tasks are considered difficult, experiences of success are more likely to result in increases in self-efficacy. Schunk (1985) suggests that self-efficacy increases when performance feedback informs students of their progress toward mastery. Evaluation that is socially comparative is less likely to facilitate high levels of self-efficacy, particularly for students deficient in basic skills. Furthermore, students must find immediate short term goals attainable in

order to develop a sense that they can successfully accomplish the more encompassing long term goals. Crooks (1988) suggests that the use of cooperative learning approaches in the classroom enable students to focus on task mastery rather than relative success or failure in comparison to their peer group. Studies have shown that the task mastery orientation is associated not only with self-efficacy but with intrinsic motivation for learning (Ames, 1984).

Social Cohesion

Social cohesion in the classroom is also considered important for maximizing learning potential in the classroom. Astin (1987) suggests that feedback regarding task performance is accepted and used more constructively by students when there is a high degree of trust among students and between students and teacher. In competitive learning situations, students feel compelled to "appear" smart, hiding any weaknesses in their skills and knowledge base from both peers and instructors. Johnson, Johnson, & Maryuma (1983) have demonstrated that cooperative learning structures lead to increased social cohesion and levels of trust in the classroom.

Purpose of the Study

College instructors often assume that the traditional lecture method is a satisfactory one for teaching at advanced levels. The responsibility of the professor is to impart increasing quantities of the most up-to-date skills and knowledge in the content area. The responsibility of successfully acquiring those skills and knowledge falls primarily on the student.

Teacher educators are in a unique position to provide the college faculty community with data-based research supporting the effectiveness of alternate models of college instruction. Just as public school teachers must stretch their repertoire of skills in order to meet the challenge of teaching an increasingly diverse population of students, college instructors must face similar challenges, particularly as they relate to the growing demand for professionals with strong problem-solving and group processing capabilities.

It is the responsibility of teacher educators not only to impart knowledge concerning effective teaching strategies, but to employ such strategies in their own college classrooms in order to maximize student

learning. In order to select the most appropriate methodologies, professors must assess the interaction between the academic content and the students' skills, motivation, perceptions of self-efficacy, and subject-related anxiety.

This study has several purposes. First, it presents the rationale and research base supporting the use of cooperative learning methodologies. Second, quantitative and qualitative data are presented to evaluate the effectiveness of this methodology for graduate level educational statistics courses. Finally, issues relating to the alignment of research methodology with instructional outcome values are raised.

Method

Subjects

Sixty-two graduate students in the school of education at a small, State university participated in this study. Thirty students were enrolled in the traditional lecture introductory statistics course. Thirty-two students were enrolled in the same course taught by a different instructor using the cooperative learning methodology. The majority of students were practicing professionals returning to school to acquire a Master's

degree and to upgrade their certification credentials. Approximately equal proportions of African-American, Euro-American men and women were represented in each class.

Procedure

The methodological format for each class is described below.

Traditional Method

The class period was approximately two and one half hours in length, meeting once a week throughout the semester. The first part of the period consisted of a review of the material covered the previous period. Problems that were assigned were reviewed and questions answered. The middle portion consisted of presenting new material. Lecture, discussion, transparencies on the overhead, and board work were the principle methods used. The last part of the period consisted of an overview of the problems assigned for the next week, and a brief review of the material covered. The textbook was closely followed.

At the beginning of the course, each student was given three groups of thirty numbers, ranging from 50 to 99. These were considered scores. Every student had a different set of numbers. These were used to calculate basic statistical values, such as means, standard deviations,

correlations, regression, t-tests of means, analysis of variance, etc.. As the course progressed, the students would compare their results with those of the instructor. It was required that problems be complete and correct by the end of the course.

Cooperative Method

The instructor for the cooperative method class was thoroughly trained and experienced in the cooperative learning methodology. Students in the cooperative class met once a week for approximately two and onel half hours. The cooperative learning methodology was incorporated through the use of base groups and informal learning groups. At the beginning of the course, students were divided into small, heterogeneous groups of four colleagues. These students solved problems together for the entire semester. Base groups provided members with support and encouragement. Every member held the responsibility of assuring that all members mastered the statistical formulas and concepts. Informal cooperative groups were also used during all class sessions. These groups consisted of randomly assigned pairs of students.

The instructor used the following specific techniques aimed at facilitating the the active engagement of the learner. First, in a focused organizer exercise, questions related to specific reading assignments

were written on the board every week. These questions served as advanced organizers to help students focus on important points in the reading for each subsequent lecture. The textbook was the same one used in the traditional method class. The same chapters were covered as well. Overhead transparencies were duplicates of those used in the traditional class.

At the beginning of every session students reviewed their assigned homework problems in their base groups. New informal student pairs were then formed and each pair reviewed the focused organizer questions using a formulate/share/ listen procedure. "Turn and tell" techniques were used during the lecture portion of the class about every fifteen minutes. This technique requires the active participation throughout the lecture by requiring students to explain to their partner the main points just made by the instructor. Students must translate the information into their own words as they attempt to demonstrate their own understanding and improve the comprehension of their partner. Finally, a focused summary exercise was used at the end of the lecture in which each pair summarized the key points of the lecture. During all of these exercises, the instructor functioned as a facilitator by monitoring group processing, modeling problem-solving skills, and providing feedback regarding

individual and group mastery. Group effectiveness for cooperation was evaluated during every class session.

Instruments

Two multiple-choice exams were given at equal intervals during the semester to evaluate mastery of course objectives. Students in the traditional and cooperative method classes took identical exams.

Students in the cooperative method class completed a paper and pencil survey at the end of the course. The survey included questions such as the following : 1) How do you feel about the cooperative learning system in this course? 2) Please comment on the following: base groups, turn to your partner, focused organizers, focused summaries. 3) Please comment on the composition and duration of base groups.

Results

A t-test was calculated on examination means in order to determine whether significant differences in achievment occurred as a result of different instructional methods. The t-test tests the hypothesis that the true means are the same. It is also based on the assumption that the variances of the two groups are equal and that the variable being tested is

normally and independently distributed within each group. No significant differences in achievement were identified for either of the statistics exams ($t=.068350$, $p>.05$; $t=.09659$, $p>.05$, respectively).

Results of the survey indicated that 96% of the students participating in the cooperative format class felt positively about the cooperative learning methodology. Base groups were considered beneficial in providing a support mechanism, reducing anxiety associated with statistics, and providing fellowship. Motivation was positively influenced by peer pressure within the base group to keep up with the work and master the content for the sake of the group as well as the individual. Students also commented that they found the class and the course content more enjoyable as a result of the base group experience.

Students indicated that more group roles should be assigned and that the instructor should engage in more group processing. 96% believed that the informal group exercises were effective in promoting communication and comprehension, and the majority of students indicated that the use of this strategy should be increased. 96% of students indicated that the focused organizers were an effective teaching strategy. 78% responded positively to the use of focused summaries; however, students indicated more time should be allotted for this strategy. Finally, all students were

pleased with the composition, size, and duration of base groups.

The following statement summarized many of the comments made by the students on this survey.

> "I think the cooperative learning system in this course made the difference in my staying throughout the course. I knew I could get the help I needed, and the very nature of this style reinforced my comprehension. I believe as a society we have become far too isolated. Cooperative learning reinforces a way of life that is less stressful and less fearful for all involved."

Discussion

The results of the statistical analysis indicate that no significant differences in achievement occurred between the two teaching methodologies. There are several limitations that occurred for this study which suggest that future research should attempt to replicate these finding before final conclusions are drawn.

One limitation concerns the relative teaching experience of the instructors involved. The traditional method professor had more than fifteen years of experience teaching statistics at the undergraduate and graduate level. The cooperative instructor was well-trained in the

cooperative methodology, however, he had little previous experience teaching graduate level statistics at the time of the study. The difference in level of teaching experience may have interacted with the levels of achievement obtained by the students in the respective classes.

Although the quantitative analyses do not support the expected increase in achievement in the cooperative method class, the qualitative data indicate that students in the cooperative method class experienced the predicted shifts in motivation, self-efficacy, and social cohesion. Reduction in anxiety relating to the subject matter content was also evidenced. Because these variables have been correlated repeatedly with increases in achievement, the lack of achievement level differences in this study has implications regarding the appropriateness of the assessment method. Cole (1990) has suggested that differing conceptions of achievement influence what teachers teach and how they teach. In addition, conceptions of achievement affect what educational researchers study and the methods they employ in studying it. She indicates that two specific conceptions predominate the current thinking: achievement as basic skills and facts, and achievement as higher order skills and advanced knowledge.

Previous research suggests that cooperative learning structures are

effective in the promotion of the latter conception of achievement. While educators are making significant progress in creating classroom environments that facilitate the growth of critical thinking skills, methods of assessing progress according to this conception of achievement are only beginning to emerge (Szetela and Nicol, 1992). Performance-based measures and portfolios are two methods that are appropriately aligned with deeper learning levels (Wolf, LeMahieu, and Eresh, 1992). It would appear, therefore, that the multiple-choice examination scores used in this study as achievement measures may not have been properly aligned with the type of achievement outcomes facilitated by the cooperative classroom structure.

It is concluded that the evidence acquired through the qualitative assessment supports the possibility that achievement level differences may have occurred in the area of higher level thinking skills and problem-solving abilities. It is suggested that future studies include evaluation methods that tap the specific achievement orientation promoted by the teaching methodology. In addition, long-range benefits resulting from increases in self-efficacy, motivation, and social cohesion may need to be evaluated. Measures of competency and productivity in the students' place of employment would be appropriate for assessing "outcome" achievement.

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